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# *Belamcanda* Included in *Iris*, and the New Combination *I. domestica* (Iridaceae: Irideae)

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**ABSTRACT.** The eastern Asian genus *Belamcanda* (Iridaceae: Irideae), with its sole species, *B. chinensis*, the leopard or blackberry lily, has long been understood to be most closely related to *Iris dichotoma* (syn. *Pardanthopsis dichotoma*), but has nevertheless been maintained as a separate genus because of its distinctive floral, fruit, and seed morphology. Molecular DNA sequence evidence shows *B. chinensis* and its sister species, *I. dichotoma*, to be nested within the large Northern Hemisphere genus *Iris* (ca. 280 spp.). Not only does consistent taxonomic treatment of genera of the Iridaceae require that *Belamcanda* be transferred to *Iris*, but we argue that taxonomy should follow the principle of monophyly, which requires that *Belamcanda* and any other genus nested in *Iris* be treated as members of that genus. A new combination, *I. domestica* (basionym *Epidendrum domesticum*), is made for *B. chinensis* (based on *Ixia chinensis*), because the name *Iris chinensis* is preoccupied. The names *Belamcanda pampaninii* Léveillé and *B. chinensis* var. *taiwanensis* S. S. Ying are here included in the synonymy of *I. domestica*.

**Key words:** *Belamcanda*, Iridaceae, Iridoideae, *Iris*, paraphyly, phylogeny.

The genus *Belamcanda* Adanson, now usually regarded as comprising a single species, *B. chinensis* (L.) DC., the leopard or blackberry lily (Mathew, 1981), is a member of the predominantly Old World tribe Irideae of subfamily Iridoideae of the Iridaceae (Goldblatt, 1990). The tribe includes the Northern Hemisphere genus *Iris* L. (ca. 280 spp.) of Eurasia, North America, and North Africa, the largely sub-Saharan African *Moraea* Miller (ca. 196 spp.), the southern African *Bobartia* L. (15 spp.), *Dietes* Salisbury ex Klatt (6 spp.), which is largely sub-Saharan African but has one species on Lord Howe Island in the southern Pacific region, and the tropical and southern African *Ferraria* Burman ex

Miller (ca. 12 spp.). Other small, formerly recognized, largely African genera, including *Barnardiella* Goldblatt (1 sp.), *Galaxia* Thunberg (15 spp.), *Gynandriris* Parlatores (9 spp.), *Hexaglottis* Ventenat (6 spp.), and *Homeria* Ventenat (32 sp.), found to be nested in *Moraea*, have been reduced, rendering *Moraea* monophyletic (Goldblatt, 1998; Goldblatt et al., 2002).

In contrast, the small genera clearly allied to, and evidently nested in, *Iris*, including *Belamcanda*, *Hermodactylus* Miller (1 sp.), and *Pardanthopsis* (Hance) L. W. Lenz (1 sp.), are usually recognized in floristic accounts. Thus *Iris*, according to current circumscriptions, is paraphyletic. The belief that these genera are most closely related to particular species or species groups within *Iris* has now been confirmed by molecular study using chloroplast DNA regions (Tillie et al., 2001). A consistent treatment of genera of the Iridaceae requires that the names of these genera be treated as synonyms of *Iris*, and, we argue, a taxonomy that follows the phylogenetic principle of taxonomic monophyly demands such treatment. That *Belamcanda chinensis* is nested in *Iris* is not only amply demonstrated by molecular analysis using two chloroplast DNA sequences (Tillie et al., 2001), but it is also the most parsimonious interpretation of evidence from more classical characters. Its basic morphology closely resembles that of *Iris* (*Pardanthopsis*) *dichotoma* Pallas in its aerial, suberect rhizome that is in effect a stem, the more or less dichotomously branched inflorescence, and short subequal dark green spathes enclosing the flowers of each inflorescence unit (a rhipidium) (Mathew, 1981). Both species have indeed been referred to the genus *Pardanthus* Ker Gawler. In addition, both species are fully deciduous, unlike most other, though by no means all, *Iris* species. These two species share the same, apparently derived, chro-

mosome number,  $2n = 32$ , and karyotype, and, despite their apparently grossly different flowers, can readily be crossed. Neither species can be crossed with any other species of *Iris* tested (Simonet, 1934). Morphological similarity combined with the biosystematic data led Lenz (1972) to segregate *I. dichotoma* as the monotypic genus *Pardanthopsis*, named for its similarity to *Pardanthus*, a nomenclatural synonym of *Belamcanda* (Ker Gawler, 1804). The “intergeneric” hybrids between *Belamcanda* and *Pardanthopsis* have been named  $\times$ *Par-dacanda* Lenz, for obvious reasons.

The segregation of *Pardanthopsis* from *Iris* overlooks its similarities to some species of *Iris*, including *I. japonica* Thunberg and other far eastern *Iris* species that have an aerial rhizome. Tillie et al.’s (2001) molecular analysis places *I. (Pardanthopsis) dichotoma* sister to *Belamcanda chinensis* with strong bootstrap support (BS 98%), but there is only moderate support for the nesting of these two species within a well-supported clade that comprises subgenus *Iris*, a western Asian and European assemblage. Nevertheless, both *Belamcanda* and *Pardanthopsis* are deeply nested in *Iris*, and we see no reasonable alternative to including both in that genus.

While the single species each of *Hermodactylus* and *Pardanthopsis* were originally, and are occasionally still, included in *Iris*, as *I. tuberosa* L. and *I. dichotoma*, respectively, *Belamcanda* has never been so treated. Thus there is no available combination in *Iris* for *B. chinensis*. We remedy this here, and formally place *Belamcanda* in the synonymy of *Iris*. According to Garay (1997), the earliest specific epithet available for transfer to *Iris* is provided by *Epidendrum domesticum* L., and the new combination *Iris domestica* is therefore provided here. The specific epithet from *Belamcanda chinensis*, based on *Ixia chinensis* L., cannot be transferred to *Iris* because of the name *I. chinensis* Curtis, a synonym of *I. japonica* Thunberg, another eastern Asian species.

#### SYSTEMATICS

***Iris*** L., Sp. Pl. 38. 1753. TYPE: *Iris*  $\times$  *germanica* L. (pro sp.).

*Belamcanda* Adanson, Fam. Pl. 2: 60 (as “*Belam-Canda*”) & 524 (as “*Belamkanda*”). 1763, nom. et orth. cons. Syn. nov. TYPE: *Belamcanda chinensis* (L.) DC., typ. cons.

*Pardanthus* Ker Gawler, Koenig & Sims Ann. Bot. 1: 246. 1804, nom. illegit. superfl. pro *Belamcanda*. TYPE: *Pardanthus chinensis* (L.) Ker Gawler.

***Iris domestica*** (L.) Goldblatt & Mabberley, comb. nov. Basionym: *Epidendrum domesticum* L., Sp. Pl. 2: 952. 1753. *Vanilla domestica* (L.) Druce, Bot. Exch. Club Soc. Brit. Isles 3: 425. 1913. TYPE: Kaempfer, Amoen. Exot. Fasc. 5: t. 869, fig. 1 [Angurèk Warnà]. 1712, based on material given to Kaempfer by “Nic. Moellerus” in Jakarta [“Batavia”], Java, Indonesia (icon, lectotype, designated by Garay (1997)). EPITYPE: [Europe, cultivated,] *E. Davall* in Herb. J. E. Smith 89.42 (bequeathed to Smith in 1798)—LINN-SM 45, fiche seen, designated here).

*Ixia chinensis* L., Sp. Pl. 36. 1753. *Belamcanda punctata* Moench, Methodus 529. 1794, nom illegit. superfl. pro *Ixia chinensis* L. *Moraea chinensis* (L.) Thunberg, Fl. Jap. 34 1784. *Belamcanda chinensis* (L.) DC., in Redouté, Liliac. 3: ad t. 121. 1805. *Pardanthus chinensis* (L.) Ker Gawler, Koenig & Sims Ann. Bot. 1: 247. 1804, nom. illegit. superfl. pro *Belamcanda chinensis* [*Pardanthus sinensis* Van Houtte, Fl. Serres Jard. Eur. 26: t. 1632. 1865–67. orthog. var.]. *Gem-mingia chinensis* (L.) Kuntze, Revis. Gen. Pl. 2: 701. 1891. comb. illeg., gen. inval. TYPE [icon]: Rheedee, Hort. Malab. 11: t. 37. 1692 (lectotype, designated here).

*Belamcanda pampaninii* Lévillé, Repert. Spec. Nov. Regni Veg. 8: 59. 1910. TYPE: China. Guizhou: Shuiyang Xian, Wangcaoba [28°12’N, 107°26’E] or Wang-ts’ao-pa [28°08’N, ca. 107°12’E] (as Kouy-Tcheou, Choui-mi-tsin, Hoang-Tsao-Pa), flowers yellow, June 1909, *Esquirol 1565* (holotype, E).

*Belamcanda chinensis* var. *taiwanensis* S. S. Ying, Col. Illustrated Plants of Taiwan 1: 237. 1980. TYPE: Taiwan Keelung, Hopingtao, Aug. 1979, S. S. Ying s.n. (HAST not seen).

The type of *Epidendrum domesticum* is a somewhat stylized illustration in Kaempfer (1712), whose description is apparently based on two completely different plants (Garay, 1997), one an orchid, probably a *Cymbidium* species, and *Belamcanda chinensis*. In Kaempfer’s account of Japanese plants it is one of the plants collected in 17th century Java by one “Nic. Moellerus,” though, remarkably, unmentioned in the compendium of van Steenis-Kruseman (1950), and given to Kaempfer who was on the island in 1689–1690 and 1692–1693. It was then included in Linnaeus’s *Species Plantarum*, where it received its first acceptable name. The plant was described by Kaempfer as a scandent parasite with variegated six-petaled flowers. The illustration, however, shows no indication of a climbing habit: only the upper portion of a branched flowering stem is drawn, with stalked multi-flowered inflorescences rather crudely shown. The flowers have six mottled tepals, five of them subequal and one irregularly twisted into what

could be mistaken for an orchid labellum. Stamens and details of the style are not shown. Although no confirmatory (“typotype”) specimen could be found by DJM in Kaempfer’s collection in the Sloane Herbarium (BM; cf. also Hinz, 2001), we agree with Garay that the illustration is a flowering stalk of *Belamcanda* with the individual rhipidia bearing two flowers raised above the characteristically short spathes. In interpreting the mixed illustration thus, Garay was able to avoid upsetting orchid nomenclature and, at the time when *Belamcanda* was considered distinct from *Iris*, this action had no effect on the iridaceous element. Here we provide an epitype as (ICBN Art. 9.7; Greuter et al., 2000) an “interpretative type [as] the lectotype . . . associated with a validly published name, is demonstrably ambiguous.” We have chosen an early cultivated collection from Europe, as we have been unable to find a suitable early sheet from Java where Moellerus gathered his material for Kaempfer.

The genus *Belamcanda* was named in 1763 by Adanson, who did not transfer *Ixia chinensis*, the single species that he cited, to the genus. That action was left to De Candolle who provided the combination in 1805. That same year John Ker Gawler assigned *I. chinensis* to his new genus *Pardanthus*, evidently unaware that this name was a later synonym of *Belamcanda*. *Gemmingia*, a genus listed in indices of plant names as another synonym of *Belamcanda*, is as far as we can determine invalid, lacking a description. The name was used by Fabricius (1763), who attributed the name to Heister, but we have not yet been able to find mention of the genus in Heister’s publications. Because it is evidently invalid, we have not listed *Gemmingia* in the synonymy above. Two species were listed by Fabricius as referable to *Gemmingia*, both listed as polynomials in the genus *Ixia*. Currently these are *Iris domestica* and *Aristea africana* (L.) Hoffmann-segg, the basionym of which is *Ixia africana* (Linnaeus, 1753). Kuntze (1891) provided the combination *G. chinensis*, which is illegitimate because *Gemmingia* is invalid. Of the works containing illustrations of the plant cited in the protologue of *Ixia chinensis* we choose the illustration in Rheede’s *Hortus Malabaricus* as the lectotype, as best representing the species. The specimen of the species in the Linnaean Herbarium is not available as a lectotype because it was added to the collection after Linnaeus’s death.

Indexes of plant names list *Iris tripedalis* Fischer ex Roemer & Schultes as a synonym of *Belamcanda chinensis*, but it is an invalid authorless name, mentioned in discussion only, in the *Mantissa* to volume 1 of Roemer & Schultes’s *Systema vegeta-*

*bilium* under the account of *I. dichotoma* (Roemer & Schultes, 1822: 306). The unlisted name *Pardanthus tricolor* Arruda ex Almeida (1873: 273) was based on material grown in Brazil but no type is known, making its identity uncertain, although this plant is very likely *I. domestica*. We are indebted to Joseph Kirkbride for drawing our attention to this name. We assume that *Belamcanda flabellata*, described by C. H. Grey in 1934 for yellow-flowered plants believed to have come from Japan, is a color variant of *Iris domestica*, but we have been unable to locate type material and do not include this name in synonymy. The yellow-flowered variety *B. chinensis* var. *taiwanensis* was included in *B. chinensis* by Zhao et al. (2000), a treatment we endorse. Although we have not seen the type, C.-I. Peng (pers. comm.) considers it a trivial variant of *I. domestica* (*B. chinensis*) with slightly smaller flowers than variety *chinensis*, which is also native in Taiwan. At least one other heterotypic synonym is known for the species. *Belamcanda pampaninii* (Léveillé, 1910; McKean, 1986), described by Hector Léveillé, is based on (apparently) wild-collected plants from China, also with predominantly yellow flowers.

All other names in *Belamcanda* and *Pardanthus* (Moench, 1794) found in standard indexes of plant names are combinations in those genera for South African species now included in *Sparaxis* Ker Gawler or *Tritonia* Ker Gawler. *Pardanthus dichotomus* (Pallas) Ledebour is *I. dichotoma*, while *P. nepalensis* Sweet, a name without description, may be *B. chinensis*.

*Iris domestica* is believed to be native to eastern China, Japan, Korea, Taiwan, and the Ussuri region of Russia (Mathew, 1981), but the plant has been in cultivation for so long a time, persists where planted, and spreads so readily from gardens, that its original distribution remains somewhat uncertain. It is treated in the *Flora of China* as native there, and is listed as also occurring in Japan, Korea, Myanmar, Vietnam, India, the Philippines, and Russia, but the authors did not differentiate its native from introduced localities (Zhao et al., 2000) and noted that the plant is “usually cultivated.” Indeed, the name *Belamcanda* is perhaps a corruption of a southwest Indian vernacular name (Nicolson et al., 1988: 294).

The distinctive features of *Iris domestica* are the subequal, spreading tepals, weakly differentiated into limb and claw (unlike other *Iris* species), and the bizarre tepal coloration, a light pink to orange base with speckles of orange to scarlet pigmentation (Fig. 1). Even more singular are the free tepals, while the style base is not embedded in hypanthi-

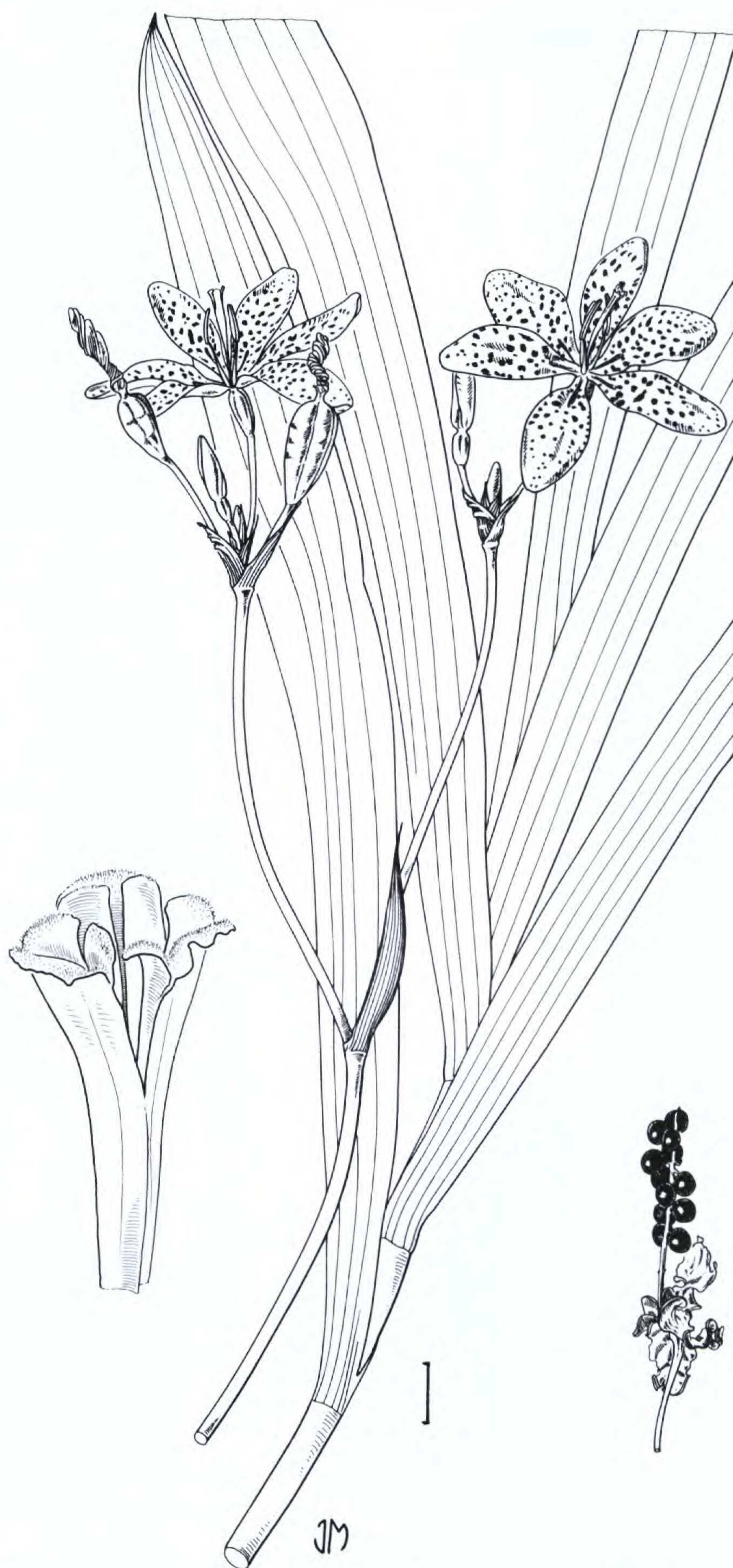


Figure 1. *Iris domestica*, flowering branch, stem base with leaves, ripe capsule, and detail of the style and style branches, each with abaxial stigma lobes and short, suberect vestigial paired crests; style branch details much enlarged. Scale bar 1 cm. Drawn by John Manning from plants cultivated at the Missouri Botanical Garden.

um tissue and the style is divided into narrow, almost filiform branches, the latter seemingly quite different from the broad, tangentially flattened, usually petal-like style branches of *Iris* that terminate in paired petal-like crests. Examination (with a 10× hand lens), however, shows that the style branches are *Iris*-like in miniature (Fig. 1). The stigma is a small abaxial lobe below the apex of each style branch, while two small flaps of sterile tissue form crest-like appendages at the adaxial apices of the style branch. This structure seems best interpreted as homologous with the more prominent style branches of other *Iris* species. The apparent reduction of the *Iris*-like style branches in *I. domestica* is paralleled in several species of the related African genus *Moraea*, notably species in section *Homeria* (Goldblatt, 1986, 1998). In *Moraea* the reduction of the style branches is associated with a shift in pollination system (Goldblatt & Bernhardt, 1999). A shift in pollination system therefore seems likely in *I. domestica*.

*Iris domestica* also differs from other *Iris* species in its globose, smooth, shiny back seeds (Fig. 1), evidently an apomorphic character state. The seeds are quite different from those of other *Iris* species, including *I. dichotoma*, and leave us marveling at their unusual structure, which we suggest is an adaptation to avian dispersal, for the seeds collectively remain attached to the axile placentas after the capsule walls have dried and curved outward, the infructescence thereby resembling a blackberry. This is reflected in one of its common names, blackberry lily, a name used in North America where it is widely naturalized (Goldblatt, 2002).

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